

# Load-settlement behaviour of Geogrid-reinforced sand cushion over soft clay beds

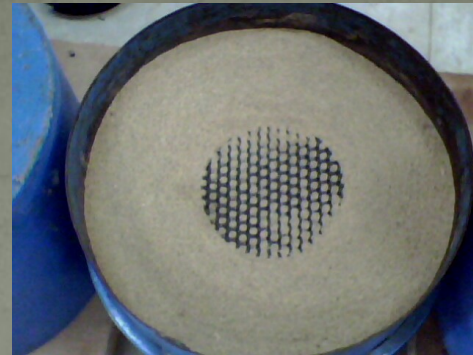


# Quick recap

- Introduction to soft clays
  - Naturally exist at their liquid limits
  - Low bearing capacity
  - Large settlements
  - Hence, structures are subjected to distress
- Objective
  - To study the efficacy of the geogrid-reinforced sand cushion in improving the engineering properties of the soft clay bed
- Basic concept
  - Sand cushion
  - Geogrid reinforcement

# Contd..

- Methodology
  - Compaction of clay bed
  - Compaction of sand bed
  - Geogrid reinforcement
  - Loading
  - Measuring the settlement
- Test variables
  - Type of sand
    - Fine sand (0.075 - 0.425 mm)
    - Medium sand ( 0.425 - 2.36 mm)
    - Coarse sand (2.36 - 4.75 mm)
  - No. of geogrids (1, 2 and 3)



# Properties of materials



sand

Property	Fine sand	Medium sand	Coarse sand
Particle size range	0.075 - 0.425 mm	0.425 - 2.36 mm	2.36 - 4.75 mm
$C_u$	1.94	3.33	1.476
$C_c$	1.244	0.625	0.96
Gradation	Poorly graded	Poorly graded	Poorly graded
Classification	SP	SP	SP

clay

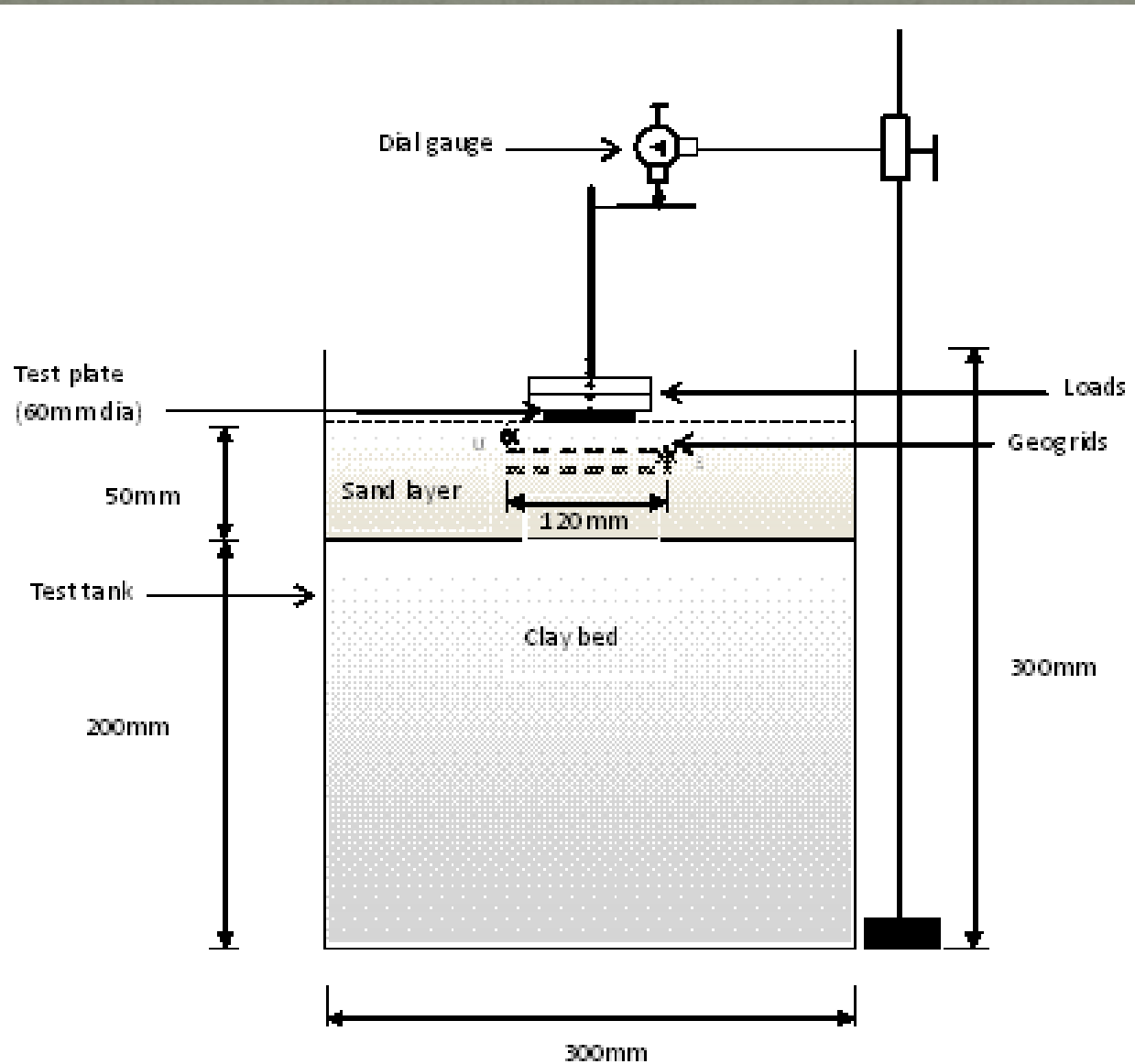
Specific gravity	2.68
Liquid limit (%)	60
Plastic limit (%)	26
Plasticity index (%)	34
<b>Compaction properties</b>	
OMC (%)	21
MDD (kN/m <sup>3</sup> )	16.6
USCS classification	CH



Geogrid

Specification	Range
Mesh aperture size	6 x 6 mm
Mesh thickness	3.3 mm
Structural weight ( $\pm 5\%$ )	7.30 g/m <sup>2</sup>
Colour	Black
Polymer	HDPE
Tensile Strength	7.68 kN/m <sup>2</sup>
Elongation at max. load.	20.2%

# Line sketch



# Experimental setup



# Results

Load(N)	clay bed (mm)		fine sand (mm)	
		n = 0	n = 1	n = 2
0	0	0	0	0
28.4	4	2	1.6	1.3
56.8	8	4	3.2	2.38
84.9	13	6.3	5	3.43
113.2	21	9	6.5	4.56
141.5	32	12.16	7.9	5.59
169.8	FAILED	15.64	9.32	6.65
198.1		18.6	10.52	7.6
226.4		21.59	11.74	8.5
254.7		24.5	13.1	9.6
283		27.42	14.27	10.7



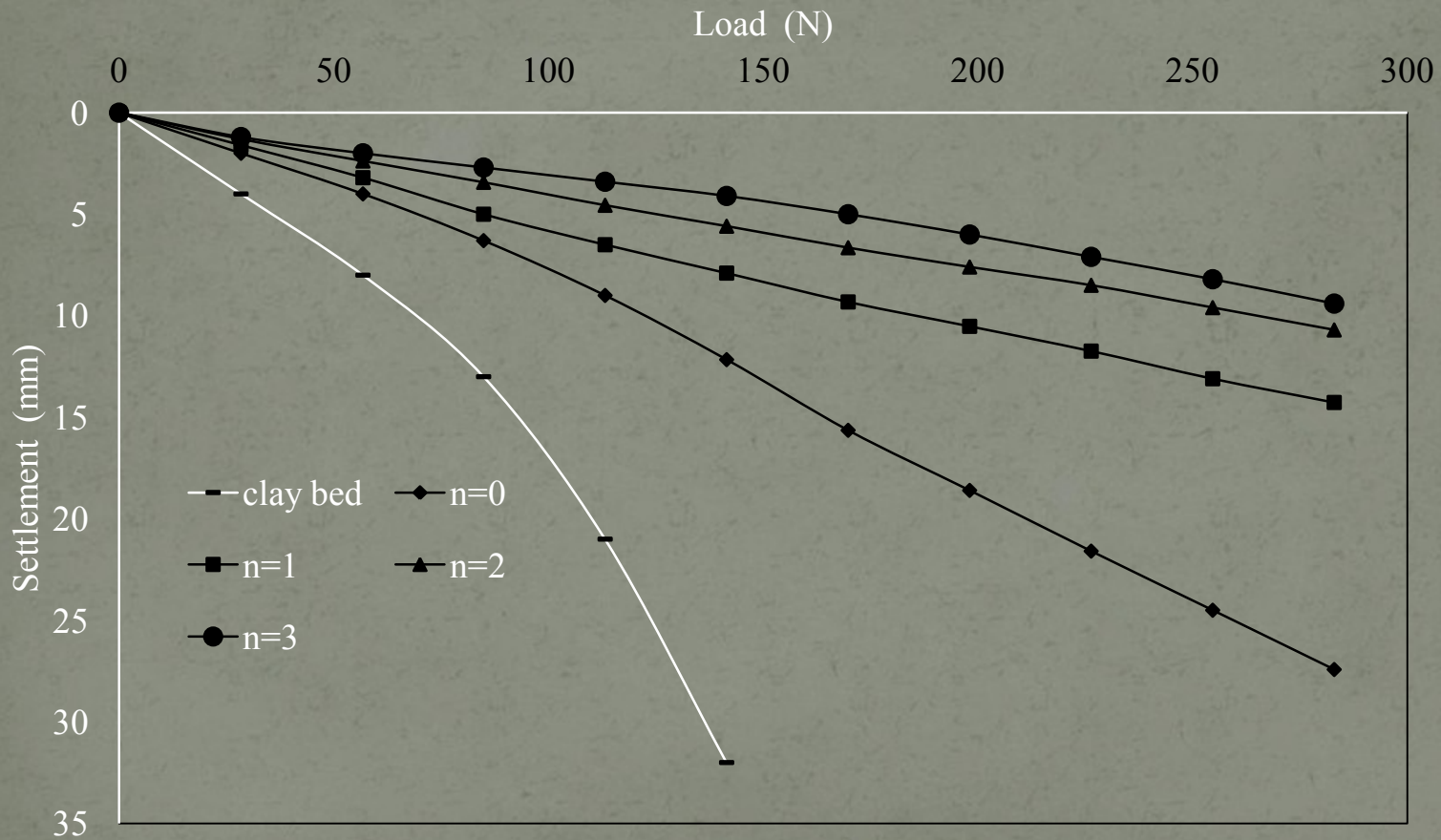
# New results

Load (N)	clay bed	Fine sand			
	(mm)	(mm)	medium sand (mm)		
		n = 3	n = 0	n = 1	n = 2
0	0	0	0	0	0
28.4	4	1.2	3	2.4	1.7
56.8	8	2	6.71	4	3.2
84.9	13	2.7	10.8	5.6	4.6
113.2	21	3.4	17.5	7.1	5.9
141.5	32	4.1	27	8.4	7.1
169.8	FAILED	5	FAILED	9.6	8.4
198.1		6		10.8	9.7
226.4		7.1		11.9	10.7
254.7		8.2		13.1	11.8
283		9.4		14.6	13.1

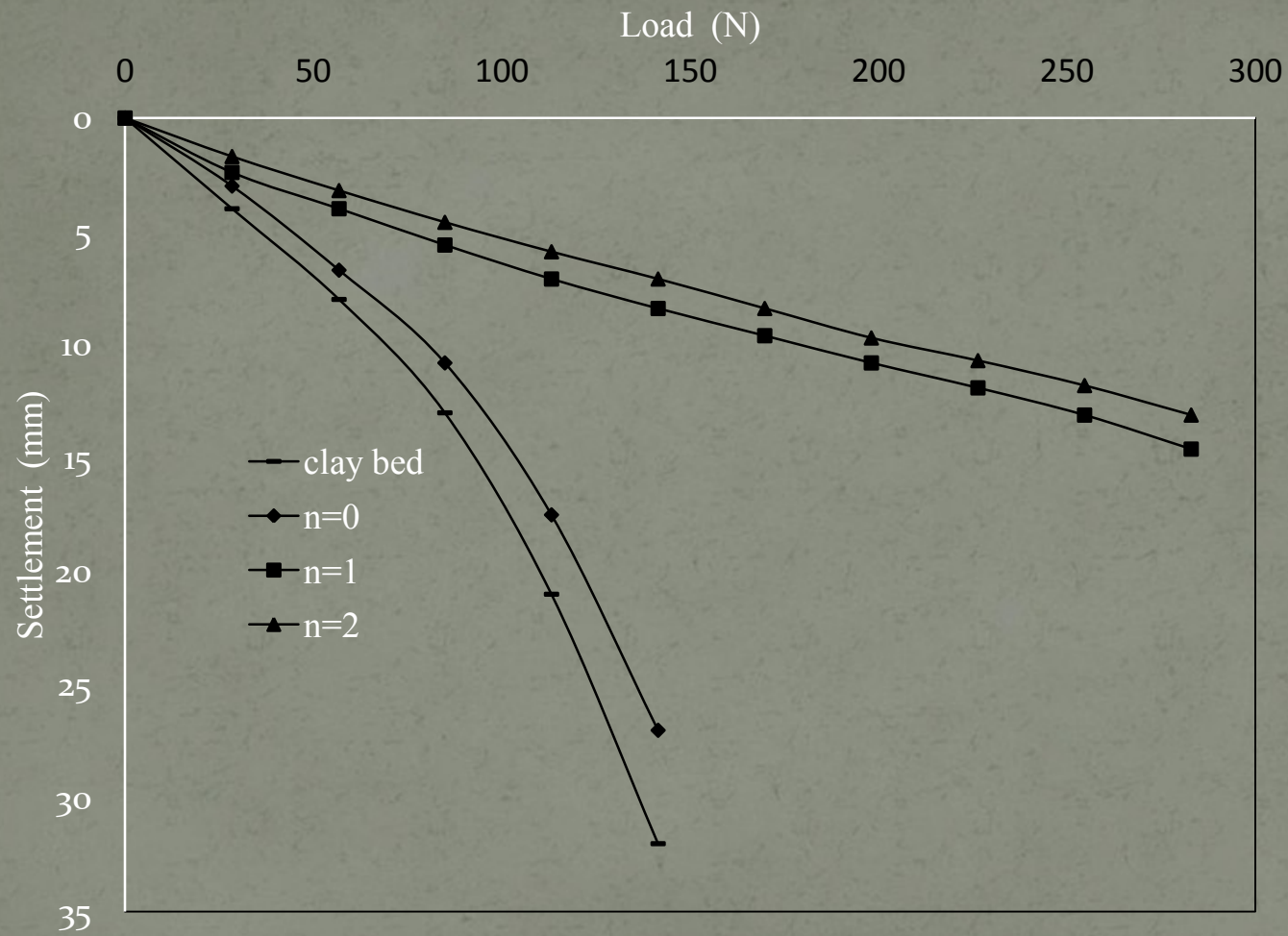




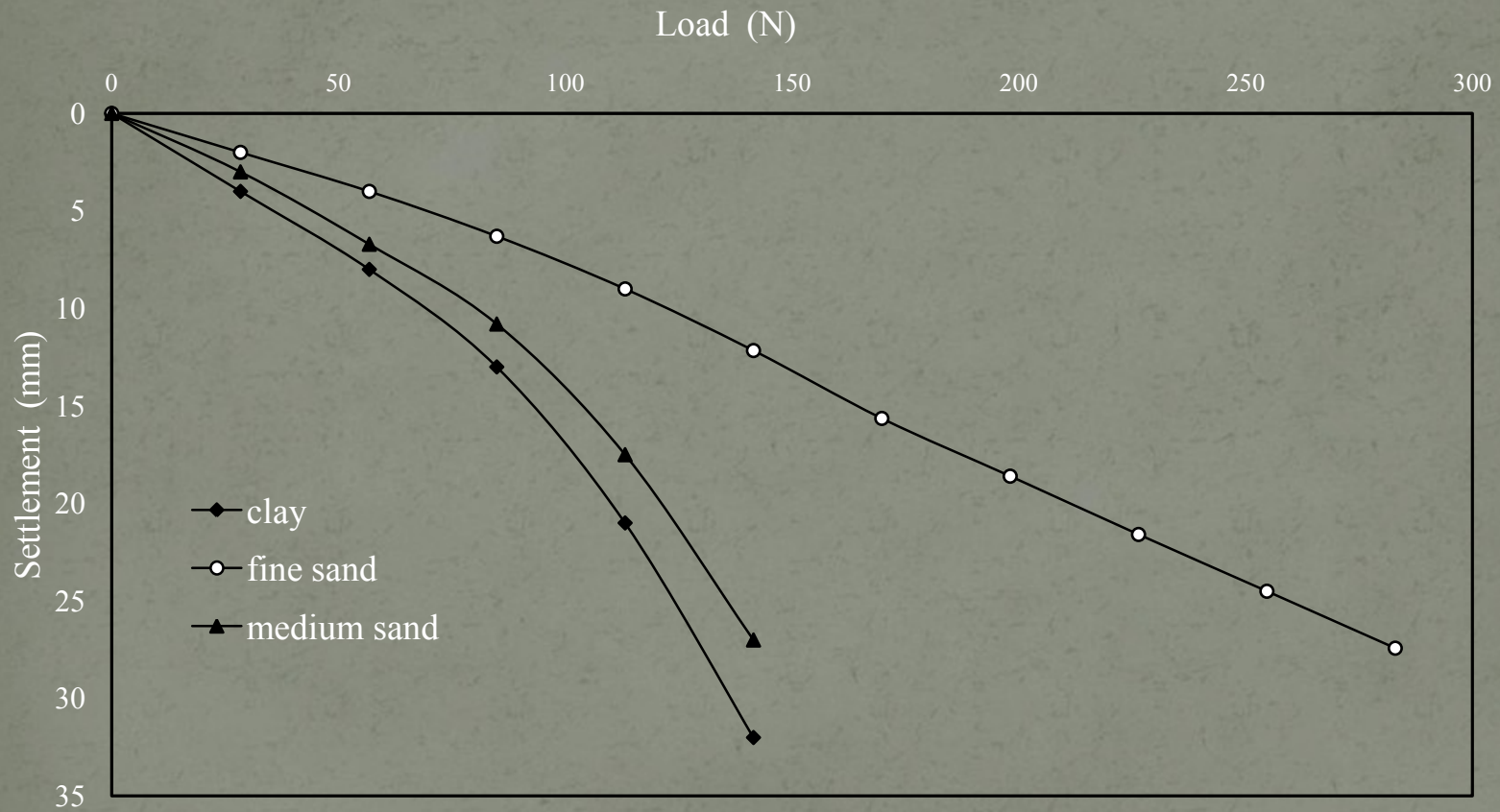
# Graphs



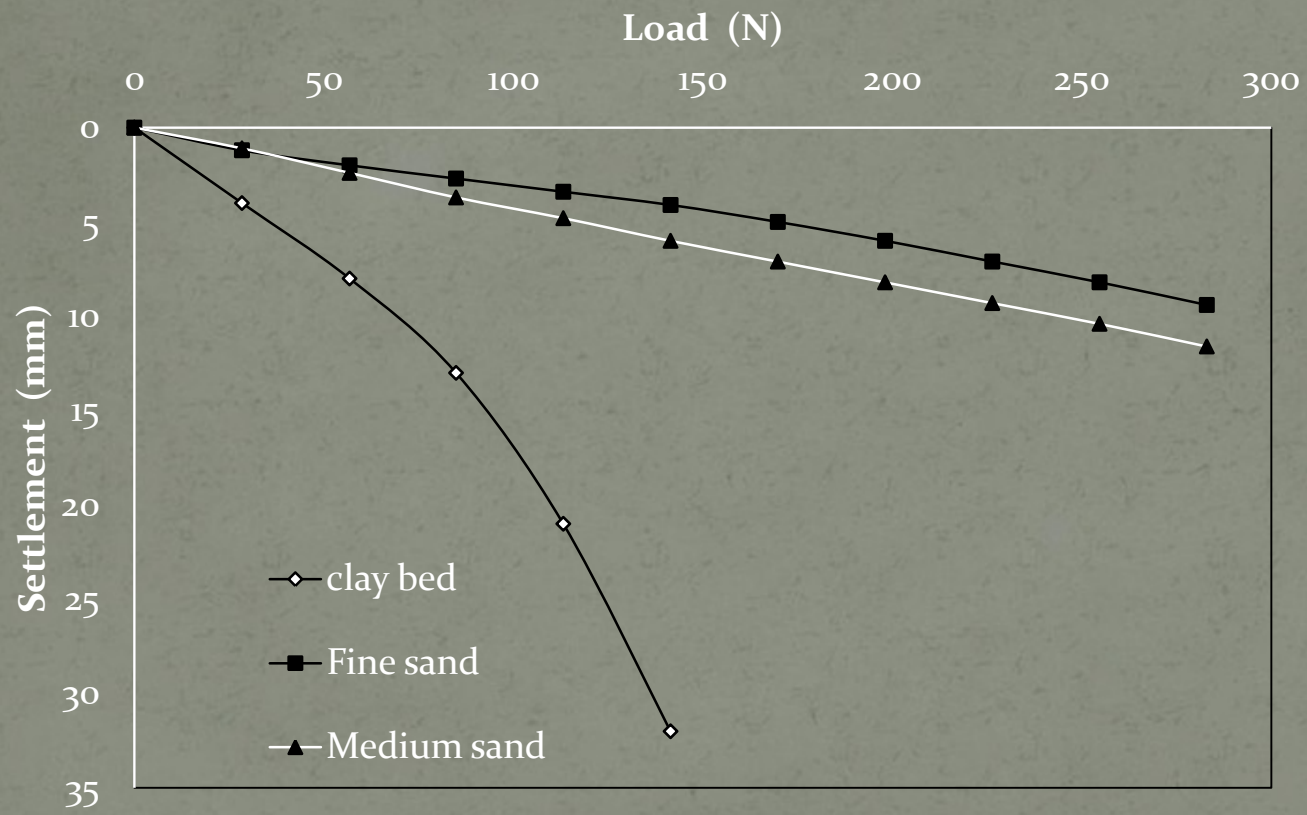
. Load-settlement characteristics; fine sand ( $n = 0, 1, 2$  and  $3$ ) and clay bed



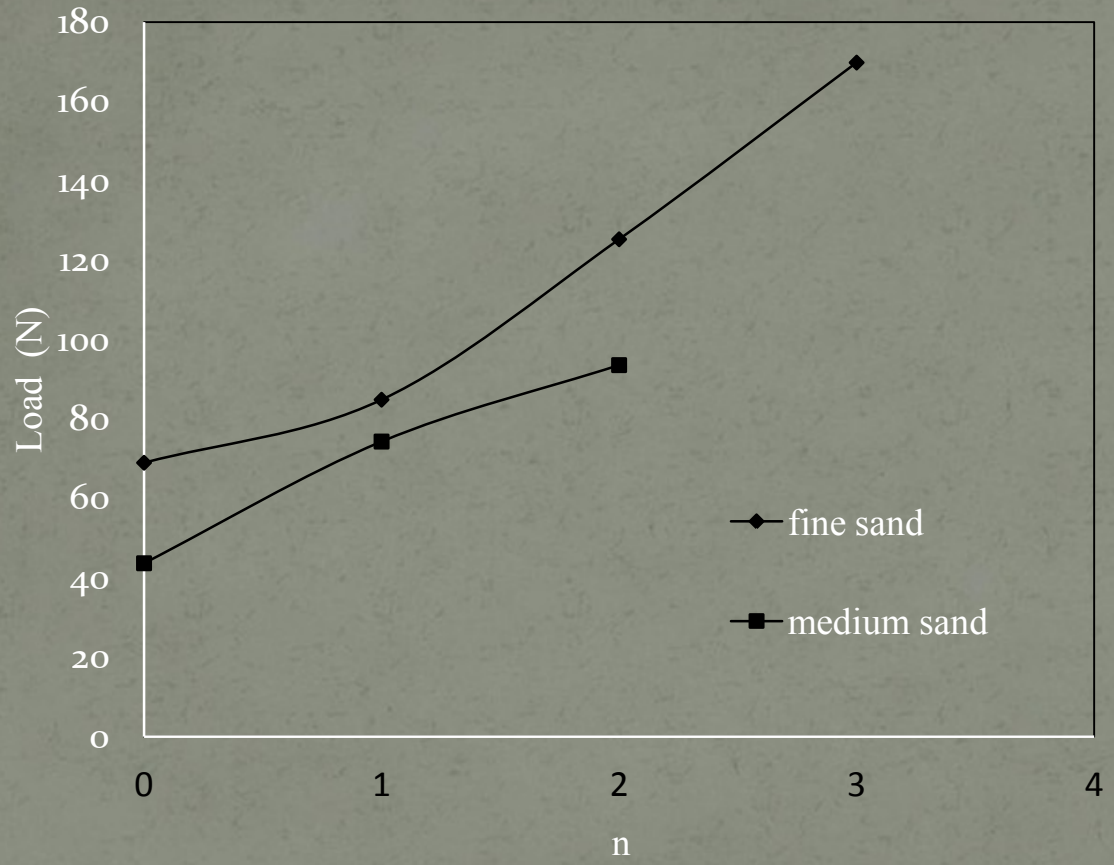
Load-settlement characteristics; medium sand (n = 0, 1, 2 and 3) and clay bed



Load-settlement characteristics (n = 0)



Load-settlement characteristics of clay and sand layers (n = 2)



Variation of load for 5 mm settlement with n

# CONCLUSION

- Bearing capacity of soft clay bed improves when sand cushion overlies the clay bed.
- Geogrid reinforcement further improves the engineering properties of soft clay with sand cushion.
- Fine sand proved better medium of making the sand cushion than medium sand, due to its high unit weight
- As the number of geogrids increased the bearing capacity further improved

# Series of tests

Clay bed

Fine sand  
cushion

Medium sand  
cushion

Coarse sand  
cushion

Geogrid  
reinforcement

n= 0,1,2,3

Geogrid  
reinforcement

n= 0,1,2,3

Geogrid  
reinforcement

n= 0,1,2,3

Thank you